

circle around the cylindrical axis, and the guide having a longitudinal axis which is substantially perpendicular to the cylindrical axis and which does not intercept the slit, and does not bisect the resident cavity, the slit having a width,  $W$ , the elongated microwave guide configured to deliver microwave radiation energy to the resonant cavity, the microwave radiation having a vacuum wavelength,  $\lambda$ , the width,  $W$ , of the slit being sized to satisfy the relationship:  $\lambda/35 < W \leq \lambda/10$ .

#### REMARKS

Claims 1, 2 and 7 are presented for further examination. Claim 7 is new.

In the Office Action mailed December 23, 2002, claim 1 was rejected because the examiner considered the relationship  $W \leq \lambda$  as a relative term that rendered the claim indefinite. Claims 1 and 2 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 4,473,596 ("Beerwald et al.") in view of U.S. Patent No. 4,877,938 ("Rau et al.").

Applicants respectfully disagree with the bases for the rejections and request reconsideration and further examination of the claims.

Turning first to the rejection under 35 U.S.C. § 112, applicants submit that the term  $W \leq \lambda/10$  is not indefinite. This claim is based on species 6, which is described on page 9, lines 9-14, where the width  $W$  of the slit and the vacuum wavelength of the microwave satisfy the relationship  $\lambda/35 < W \leq \lambda/10$ . The vacuum wavelength as used in the resonator is common knowledge for one of ordinary skill in the art. Enclosed is a copy of the Handbook of Chemistry and Physics, page 10-257 to page 10-258 in which a classification of electromagnetic radiation can be found.

Turning to the rejection under 35 U.S.C. § 103(a), Rau et al. discloses a method of low energy consumption and a device of simple construction for coating the inside of a tube. The object of Rau et al. is achieved with a cylindrical microwave resonator configured to produce TE 011 microwave energy in the tube. Rau et al. specifically teaches that the ratio of the diameter to the height of the microwave resonator is determined by the TE 011 resonance in the microwave resonator (see column 2, lines 54-59).

At column 3, lines 43-45, Rau et al. discloses that the resonance frequency depends on the overall *length* of the inner resonance space. Therefore, the TE 011 resonator has a movable wall surface 31 that can be moved for tuning the resonant frequency to the operating

frequency (see column 4, lines 5-7). The inward or outward movement is indicated by the arrow 5, which means that the overall *length* of the inner resonant space is influenced.

In contrast, the present invention provides a PCVD apparatus in which a plasma having improved rotational symmetry can be generated. As disclosed on page 2, lines 25-28 of the originally-filed application, increasing the diameter of the resonant cavity so as to enable use of a thicker substrate tube generally leads to a plasma with deteriorated rotational symmetry. According to the present invention, this is achieved by a cavity that is annular, which allows a more efficient standing wave generation; the slit in the inner wall of the annular cavity is then the only means by which a plasma can be generated by such standing waves, via a leakage field. Moreover, since the longitudinal axis of the microwave guide does not intercept the slit, the microwave energy carried by the guide cannot directly enter the plasma, resulting in more controlled and efficient mode excitation in the cavity (see page 3, lines 20-27). Furthermore, the antecedent basis for claim 1 can be found on page 9, lines 9-14, wherein it is stated that  $W < \lambda/10$ , allowing for an electric field strength large enough for plasma generation. In addition, when  $W < \lambda/35$ , the electric field strength in the slit 13 may become too large, resulting in a so-called "flashover" phenomenon known in the art.

It is to be noted that Rau et al. is totally silent about the size of the slit, *i.e.*, the width  $W$ , let alone the claimed relationship between  $W$  and the vacuum wavelength  $\lambda$ .

There is no teaching or suggestion in either Beerwald et al. or in Rau et al., or in any combination thereof separate from applicants' disclosure to suggest that these references be combined, much less combined in the manner as claimed. Even if one were motivated to combine the references as the Examiner suggests, such combination would not show all of the novel physical features recited in claim 1. These physical features produce new and unexpected results, and hence are nonobvious and patentable over these references.

Even if one were motivated to combine the references as the Examiner suggests, claim 1 would still have novel and nonobvious physical features over the proposed combination. In other words, the recited combination of claim 1 comprises more than merely implementing the microwave cavity as taught by Rau et al. in the apparatus of Beerwald et al. More specifically, claim 1 discloses a guide having longitudinal axis that is substantially perpendicular to the

cylindrical axis and which does not intersect the slit. This technical feature is neither suggested nor disclosed by either one of the references taken individually or in any combination thereof.

In view of the foregoing, applicants respectfully that claim 1 and dependent claim 2 are in condition for allowance.

New claim 7 is a combination of claims 1 and 2 with the additional recitation that the longitudinal axis does not bisect the resident cavity. Applicants respectfully submit that claim 7 is clearly allowable for the reasons why claims 1 and 2 are allowable.

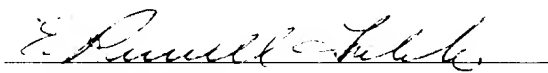
In view of the foregoing, applicants submit that all of the claims in this application are in condition for allowance. In the event the Examiner finds minor informalities that can be resolved by telephone conference, the Examiner is urged to contact applicants' undersigned representative by telephone at (206) 622-4900 in order to expeditiously resolve prosecution of this application. Consequently, early and favorable action allowing these claims and passing this case to issuance is respectfully solicited.

The Commissioner is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

Respectfully submitted,

Antonius Henricus Elisabeth Breuls et al.

SEED Intellectual Property Law Group PLLC



E. Russell Tarleton

Registration No. 31,800

ERT:aep

Enclosures:

Postcard

Handbook of Chemistry and Physics, page 10-257 to page 10-258

701 Fifth Avenue, Suite 6300  
Seattle, Washington 98104-7092  
Phone: (206) 622-4900  
Fax: (206) 682-6031

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